Habituation, ecotourism and research for conservation of western gorillas in Central African Republic – Bai Hokou

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The south-western region of the Central African Republic reminds one of a paradisiacal habitat, harbouring an exceptional faunal diversity: there are forest elephants, forest buffaloes, sitatungas, bongos, several duiker species, two species of forest pigs, and ten primate species besides gorillas and chimpanzees. Large mammals are important flagship species that, when endangered and charismatic, have the potential to attract international attention for their conservation. Gorillas are a perfect example, raising great international attention as shown by the announcement of this year as "The Year of the Gorilla". Even though continuous efforts have been made towards its conservation, the need to protect such a charismatic primate is still impellent. Throughout their range, western gorillas (*Gorilla gorilla*) are endangered not only by habitat destruction and poaching, but also by threats unrelated to human activities. As a consequence of the tremendous decline of western gorilla populations in Gabon and Republic of Congo due to Ebola outbreaks, the IUCN recently classified western gorillas as "critically endangered". Despite the great international attention, very little information based on direct observation is available on western gorilla ecology, behavior and natural history, creating a crucial necessity to fill this gap.

The south-western region of the Central African Republic is also characterized by the presence of natural forest clearings ('bai' in the local pygmy language) of different sizes. These allow an easy observation of large mammals, including gorillas and elephants, since the animals are attracted by mineral rich soil, clay and aquatic plants. Acknowledging the high biodiversity and the high tourist potential of the area, a system of protected areas was officially created in 1990. Under the direction of the Dzanga-Sangha Project, today named Dzanga-Sangha Protected Areas, it consists of 1) the Dzanga-Ndoki National Park, integrally protected, and 2) the Dzanga-Sangha Dense Forest Special Reserve where local people can carry out legal forest activities (Fig.1). The project is a partnership between the World Wildlife Fund (WWF), the Central African Republic government, and, since 1994, the German Technical Cooperation (GTZ). The long-term goals of the project are: 1) to protect the forest ecosystem from changes in forest cover due to increase in logging activities and illegal hunting, and 2) to promote sustainable development in the region through a rational use of natural resources. Until now Dzanga-Sangha Protected Areas has greatly contributed to the protection of western gorillas and forest elephants, preserving their habitat and supporting ecological and behavioral scientific studies. Today the Dzanga-Ndoki National Park, together with the Lobéké National Park in Cameroon and the Nouabalé-Ndoki National Park in the Republic of Congo, is part of a larger system of protected areas called the Sangha Trinational Complex (Fig.1). The Trinational Complex is one of the best examples of organized conservation planning in the Congo Basin covering contiguous lowland tropical rainforest of critical biological significance, and supporting one of the most pristine blocks of protected forest in Central Africa.

One of the several forest clearings in the Dzanga sector of the Dzanga-Ndoki National Park is Bai Hokou (Fig. 1), chosen as camp site in the forest and headquarter for research and tourist activities. At Bai Hokou, the Dzanga-Sangha Protected Areas created the "Primate Habituation Programme" under the direction of C. Cipolletta, now run by A. Todd. Its long-term objective is to develop eco-tourism based on viewing of gorillas and other primates. Gorilla tourism draws national and international attention to problems involved in protecting the ecosystem where gorillas live, and increases support for higher conservation efforts. Good examples are found in Rwanda and Uganda, where gorilla ecotourism has been contributing significantly to conservation of mountain gorillas (*Gorilla beringei*) and the livelihood of local people. However, developing gorilla ecotourism in Central Africa has been more difficult since western gorillas have been particularly challenging to habituate to human presence, much more so than mountain gorillas. Difficulties are linked to the lowland forest habitat (i.e. limited visibility and unclear tracks left by gorillas) and differences in their sociality (i.e. wider group spread, and possibly higher rate of changes in group dynamics). In Bai Hokou, gorilla habituation was successful thanks to the unparalleled knowledge of the forest by the native Ba'Aka pygmies, who retain their traditional lifestyle in this area. However, when habituating animals, especially primates, risks associated with habituation must be taken into account. The success of Bai Hokou in habituating western gorillas is also due to rigorous application of rules aimed at minimizing risks of disease transmission from humans to gorillas. In fact, since gorillas are one of our closest relatives, it is likely that they contract human diseases when they are in proximity to tourists, researchers, and local assistants. These diseases might have devastating effects, given that gorillas likely lack the appropriate antibodies. In addition, the long-term action of the Dzanga-Sangha Protected Areas guarantees constant protection of the habituated gorillas that become more vulnerable to poachers, having lost their fear of approaching humans.

With respect to other Central African conservation projects, where gorillas are observed from platforms in open clearings, the unique advantage of Bai-Hokou is that researchers and tourists can follow the daily life of this elusive primate into the forest. The recent success of habituation of western gorillas is starting to gradually fill the gap in our knowledge on western gorilla socioecology. Until recently, information based on direct observation of gorilla behavioral ecology was limited to few, specific habitats, such as forest clearings, or to the well studied population of mountain gorillas. However, mountain and lowland habitats differ dramatically and accordingly the socio-ecology of western and mountain gorillas. Long term research and monitoring of habituated groups of western gorillas are fundamental to increase our understanding of their nutritional and habitat requirements, their life history and their social dynamics. In Bai Hokou four western gorilla groups are currently identified and/or daily followed. Two groups are in the process of habituation, a third group, called 'Mayele', is currently semi-habituated and almost ready to receive tourists and researchers. The fourth group is 'Makumba', one of the only two groups of western gorillas in the whole of Africa fully habituated to human presence. The group was first located in 2001 by A. Todd, and since early 2002 it has been followed daily, becoming fully habituated only in 2007-2008. Thanks to skilled Ba'Aka trackers this group is located every day at the night nest site and followed closely from dawn to dusk, till gorillas stop again to build new nests for the following night. Since the beginning of the habituation the group composition had changed several times, including transfers of three subadult individuals, one death of a one year old infant (for natural reason) and the following transfer of his mother. Today group 'Makumba'

consists of one silverback, three adult females, one black black-back, three juveniles and three infants.

In 2000, together with collaborators, I started to investigate in Bai Hokou how habitat and seasonal changes in food availability influence western gorilla feeding ecology, examining in particular gorilla food choice in relation to nutritional and energetic value of available food. We found that even though gorillas become more frugivorous when fruit is more available in the habitat, their energy budget and energy requirements do not change throughout the year. During periods of fruit scarcity western gorillas can still relay on high quality young leaves and herbs. Investigating the behavioral responses of gorillas to seasonal changes in food availability helps us to understand the diverse adaptations of apes to different environments, and provides us with insights on their resilience to respond to habitat alteration associated to deforestation and forest degradation. Currently we are continuing our research to obtain a complete picture of western gorilla food choice. We are going to integrate our previous data on nutritional and energetic values of gorilla food with new data of direct observations of gorilla feeding behaviour, with gorilla health monitoring (including fecal, urine and genetic analysis of each individual of group 'Makumba') and with phytochemical analyses of plants consumed by gorillas. We aim to understand if gorillas choose plants in relation to their health condition and the medicinal properties of plants, rather then only in relation to the nutritional value of plants. Our goal is also to investigate the ontogeny of food choice, focusing on possible social influences on young gorillas during acquisition of diet and information on plants. Lastly, we aim to quantify the overlap between the native forest population of Ba'Aka pygmies and gorillas in the use of forest products. Preliminary results show that gorillas consume many plants used by local Ba'Aka pygmies in traditional medicine. Since this research requires active involvement of the local pygmy communities, we hope to increase awareness and understanding of the value of forest biodiversity for both local human and gorilla populations. One of the often quoted benefits of preserving tropical forests and its biodiversity both for apes and humans is the role as a reservoir of important medicinal components. This long-term research forms part of a larger comparative project on great apes, supervised by Dr S. Krief, which will enhance our understanding of the interaction between our closest relatives and their habitat, providing important insights for understanding human origins and coevolution of great apes, humans, and diseases.

The success of habituating western gorillas in Bai Hokou has greatly contributed to western gorilla protection, has allowed gorilla ecotourism, and continues to fill the gap in our knowledge on western gorillas. A better understanding of western gorilla socioecology, nutritional, energetic and habitat requirements provides useful information to improve conservation plans for this elusive species and can inform gorilla management in captivity and in sanctuaries.

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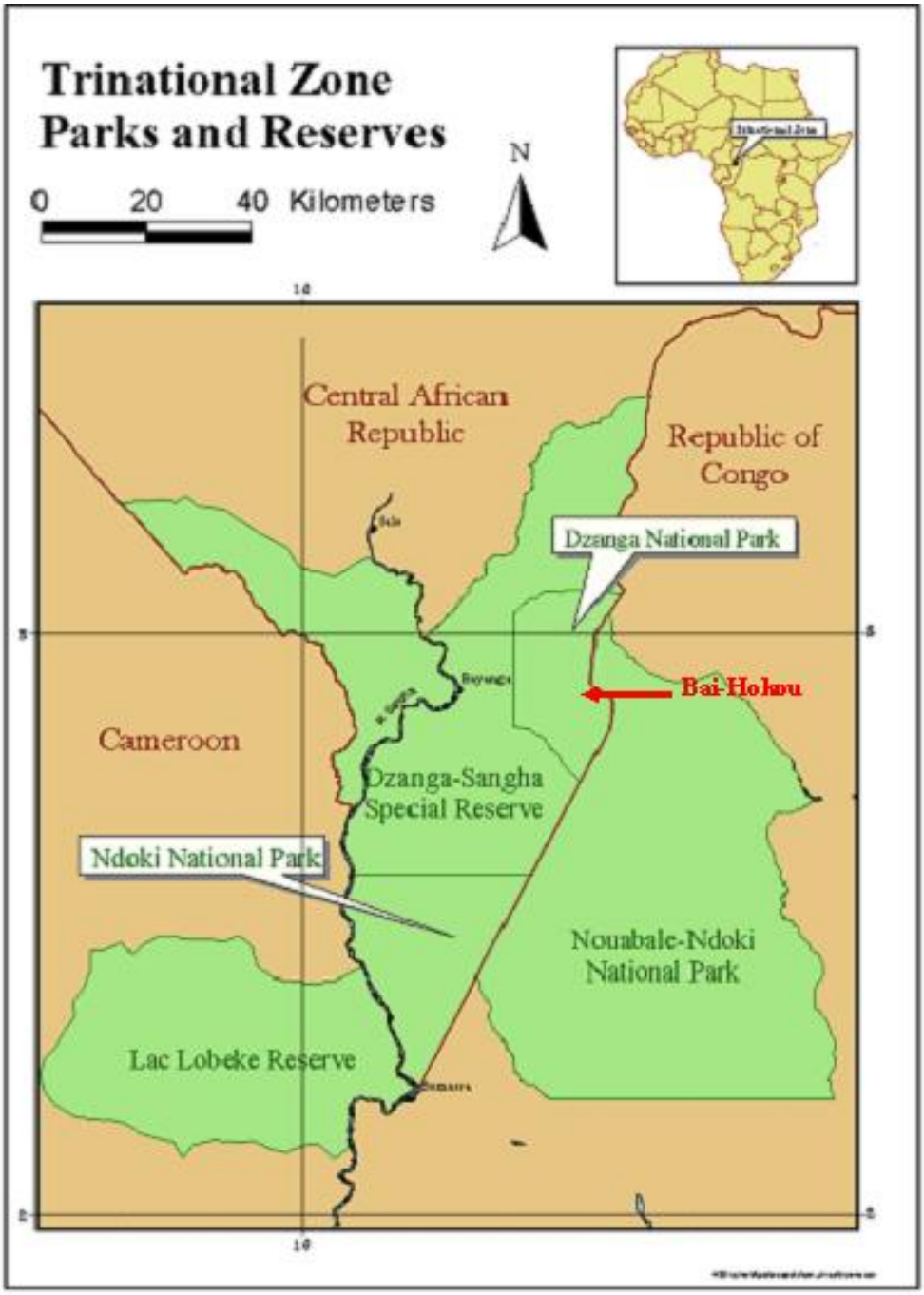

Fig. 1. Map of the Sangha Trinational Complex. The study site, Bai-Hokou, is indicated in the map.